A *T*otal *M*aximum *D*aily *L*oad Implementation Plan for Fecal Coliform

DRAFT

Submitted to
The Stakeholders of
North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River Watersheds

On Behalf of
The Commonwealth of Virginia:
Department of Conservation and Recreation

Prepared by

MapTech

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Introduction

TMDL is an acronym for Total Maximum Daily Load, which is the maximum amount of pollutant that a water body can assimilate without surpassing the state water quality standard. If the water body surpasses the water quality standard 10% of the time during an assessment period, the water body is placed on the Commonwealth of Virginia's 303(d) List of Impaired Waters. North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River were placed on this list because of violations of the fecal coliform (FC) bacteria water quality standard. After this listing, FC TMDL Plans were developed for each impairment. After TMDL plans are written, Virginia's 1997 Water Quality Monitoring, Information and Restoration Act states in section 62.1-44.19:7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters". In fulfilling the state's requirement for the development of a TMDL Implementation Plan, a framework was established for reducing FC levels and achieving the water quality goals for which TMDL allocations were developed. With successful completion of the implementation plan, Virginia will be well on the way to restoring the impaired waters and enhancing the value of this important resource. Additionally, development of an approved implementation plan will improve the localities chances for obtaining monetary assistance during implementation.

It has been documented time and again the detrimental affects of bacteria in food and water supplies. For example, May 2000, in Walkerton, Ontario a town of approximately 5000 people, there were seven confirmed deaths with four other deaths under investigation, and over 2000 poisonings all attributed to drinking water polluted by E. *coli* Type 0157:H7 (Raine, 2000, Miller, 2000). Financially, the contamination resulted in a $250 million class action lawsuit filed against the Ontario government. The source of the pollution according to the Cattleman's Association was probably runoff from a feedlot located more than 5 miles from the wells used for the town's water supply. According to veterinarian Gerald Ollis, cattle are the "number one reservoir for this type of E. *coli* " and five to forty percent of cattle shed the bacteria at any given time. E. *coli* is a type of fecal coliform bacteria commonly found in intestines of humans and animals. August 8, 1994, VDH was notified of campers and counselors at a Shenandoah Valley summer camp developing bloody diarrhea. E. *coli* 0157:H7 was confirmed as the causative agent (CDC, 1995). In Franklin County Virginia, 1997, an outbreak of illnesses involving three children was attributed to E. *coli* (0157:H7) in Smith Mountain Lake. The children were exposed to the bacteria while swimming in the lake and a two year old hospitalized almost died because of the exposure (Roanoke Times, 1997a, 1997b, 1998b). In August of 1998, 7 children and 2 adults at a Day-care Center in rural Floyd County were infected with E. *coli* (0157:H7). Upon investigation, two of the properties' wells tested positive for total coliform (Roanoke Times, 1998a, 1998c). June 6, 2000, Crystal Spring, Roanoke Virginia's second largest water source was shut down by Virginia Department of Health for E. *coli* contamination (Roanoke Times, 2000).

Isolated cases? No. Throughout the U.S., the Center for Disease Control estimates at least 73,000 cases of illnesses and 61 deaths per year caused by this one fecal coliform pathogen (i.e. E. *coli* 0157:H7 bacteria) (CDC, 2001). Other fecal coliform pathogens (e.g. E. *coli* 0111) are responsible for similar illnesses. In addition, other bacterial and viral pathogens are indicated by the presence of fecal coliforms. Whether the source of

contamination is human or livestock the threat of these pathogens appears more prevalent as both populations increase. As stakeholders we must assess the risk we are willing to accept and then implement measures to safeguard the public from these risks. Water quality standards are society's implementation of legislative measures resulting from an assessment of the acceptable risks.

Key components of the implementation plan are discussed in the following sections:

- τ Review of the TMDL Development Study;
- τ Description of Water Quality Monitoring;
- τ Process for Public Participation;
- τ Assessment of Needs;
- τ Cost / Benefit Analysis; and
- τ Implementation.

This booklet is an abbreviated version of the full plan, which can be obtained by contacting one of the offices listed on the back cover.

Review of TMDL Development Plan

The South Fork Blackwater River, North Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River are part of the Blackwater River watershed, located in Franklin County, Virginia, just north of Rocky Mount, VA and approximately 15 miles to the south of Roanoke, Virginia (Figure 1). The South Fork Blackwater River watershed, from Bent Mountain downstream to the confluence with North Fork Blackwater River, is approximately 17,706 acres of which forested (75%) and agricultural (24%) land uses dominate. North Fork Blackwater River watershed, approximately 20,576 acres (72% forested and 26% agricultural land uses), joins South Fork Blackwater River to form the Upper Blackwater River. The total area of the Upper Blackwater River watershed is approximately 8,815 acres, with forest and agriculture the primary land uses (about 56% and 40%, respectively). The Middle Blackwater River watershed is approximately 23,206 acres comprised of forest (55%), agricultural (38%), and urban (7%) land uses.

Summary of the TMDL development included:

- All livestock must be excluded from streams within all impairments;
- All straight pipes must be identified and corrected within all impairments;
- Implicit in the requirement for correction of straight pipes is the need to maintain all functional septic systems;
- Reduce wildlife direct deposition in South Fork Blackwater River, North Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River by 60%, 60%, 75%, and 35%, respectively; and
- Anthropogenic FC sources will be addressed in stage I of the implementation plan, setting aside any reduction of wildlife. The VADEQ will re-assess streams after stage I to determine if water quality standards had been attained, if not, wildlife sources will be addressed.

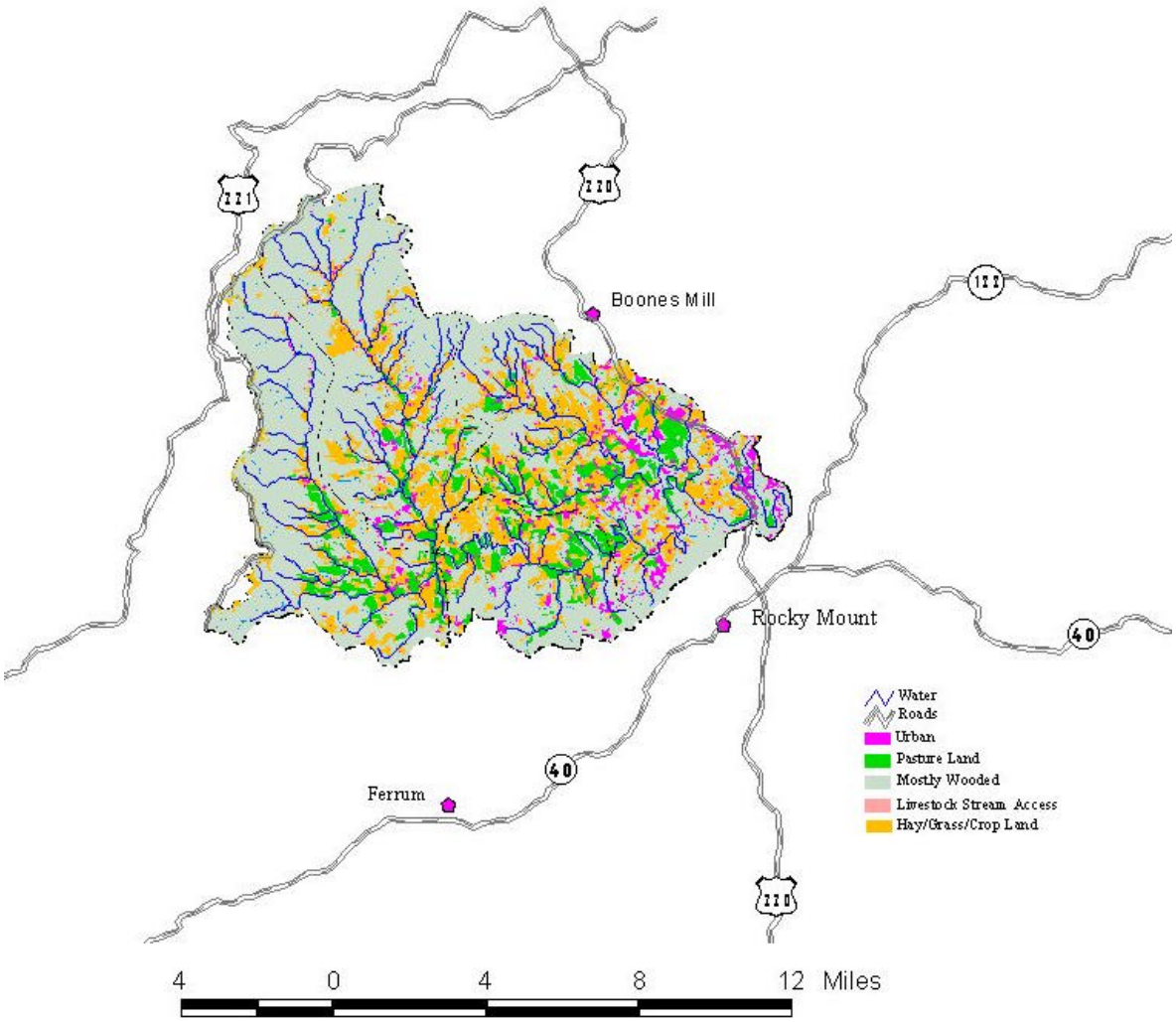


Figure 1 **Land uses in the North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River Watersheds.**

Description of Water Quality Monitoring

Monitoring at 12 fixed sampling sites throughout South Fork Blackwater River, North Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River was performed monthly (Figure 2). Of the 12 fixed sampling sites, nine sites corresponded to subwatershed outlets outlined in the TMDL development. Of the remaining three sites, one site was located at the headwaters of North Fork Blackwater River; one site was located at the headwaters of South Fork Blackwater River; and one site was at the headwaters of the Upper Blackwater River (i.e. downstream from North Fork Blackwater River and South Fork Blackwater River confluence). Two additional sites at the mouths of Buck Run and Little Creek were alternatively used each month to help refine the spatial distribution of pollutant sources. All water samples were analyzed for fecal coliform and fecal streptococcus. Bacterial Source Tracking was also run on each sample using Antibiotic Resistance Analysis, yielding the percentage of isolates classified as human, livestock, and wildlife. Monitoring indicated a contribution of fecal coliform from livestock, human, and wildlife sources (Table 1). For the South Fork Blackwater River and North Fork Blackwater River, consistently higher fecal coliform concentrations were monitored at the outlet of each. Livestock appears to be an issue in these lower subwatersheds. The higher fecal coliform levels continue to exist in the upstream subwatersheds in the Upper Blackwater River with livestock as the predominant source followed by a mix of wildlife and human. Human sources seem most significant in the Middle Blackwater River watershed coupled with livestock.

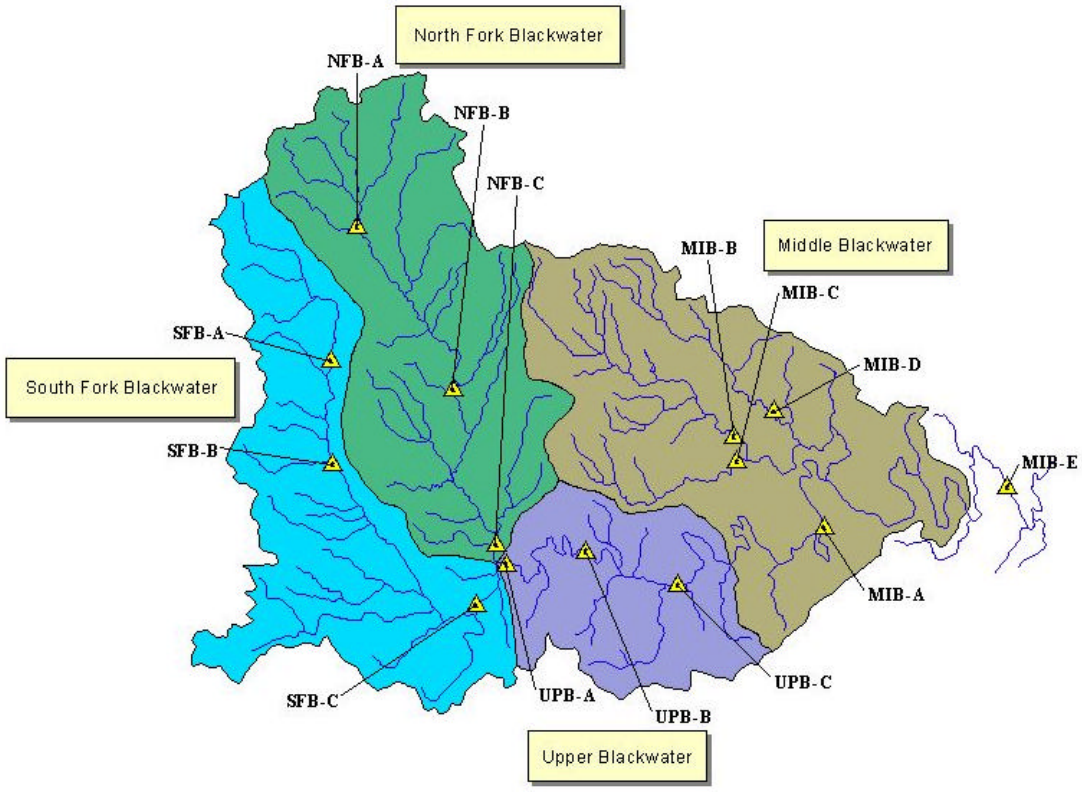


Figure 2 **Monitoring stations within North Fork Blackwater River (NFB), South Fork Blackwater River (SFB), Upper Blackwater River (UPB), and Middle Blackwater River (MIB) Watersheds.**

Table 1 Preliminary water quality monitoring results for North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River.

Impairment	Station	% Violations (> 1,000 cfu/100ml)	Human (%)	Livestock (%)	Wildlife (%)
North Fork Blackwater R.	NFB-A	0	32	44	24
	NFB-B	20	7	54	39
	NFB-C	30	25	55	20
South Fork Blackwater R.	SFB-A	20	28	46	26
	SFB-B	10	10	67	23
	SFB-C	60	22	61	17
Upper Blackwater R.	UPB-A	50	20	40	40
	UPB-B	20	11	70	19
	UPB-C	20	17	63	20
Middle Blackwater R.	MIB-A	20	55	33	12
	MIB-B[1]	60	16	76	8
	MIB-C[2]	80	29	46	25
	MIB-D	40	39	41	20
	MIB-E	20	56	37	7

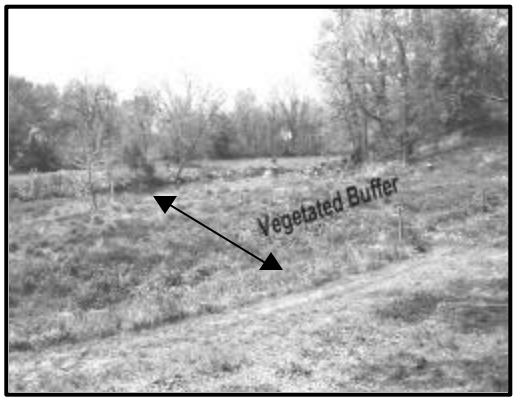
1 – Sampled station in October, November, January, March, and May only.
2 - Sampled station in November, January, February, April, and June only.

Process for Public Participation

The actions and commitments described in this document are drawn together through input from citizens of the watersheds, the Franklin County government, Virginia Department of Conservation and Recreation (VADCR), Virginia Department of Environmental Quality (VADEQ), Virginia Department of Health (VDH), Virginia Cooperative Extension Service (VACES), Natural Resources Conservation Service (NRCS), Blue Ridge Soil and Water Conservation District (BRSWCD), Virginia Department of Agriculture and Consumer Services (VDACS), Franklin County Farm Bureau Association, Virginia State Dairymen's Association, and MapTech, Inc. Every citizen and interested party in the watersheds is encouraged to become involved in this initiative and contribute what they are able to help restore the health of the streams. Public participation took place on three levels. First, public meetings were held to provide an opportunity for informing the public as to the end goals and status of the project, as well as, a forum for soliciting participation in the smaller, more-targeted meetings (i.e. focus groups and steering committee). Second, focus groups were assembled from communities of people with common concerns regarding the TMDL process and were the primary arena for seeking public input. The following focus groups were formed: Agricultural, Residential, Environmental, and Governmental. Due to a low number of volunteers, formal meetings of the Residential and Environmental Focus Groups were not held, instead comments were addressed in the Governmental Focus Group and Steering Committee. A representative from VADCR and MapTech attended each focus group in order to facilitate the process and integrate information collected

from the various communities. Third, a steering committee was formed with representation from all the focus groups, VADCR, VADEQ, VDH, and MapTech. Over 600 man-hours were devoted to attending these meetings by individuals representing agricultural, residential, commercial, environmental, and governmental interests on a local, state, and federal level.

Varied opinions were voiced throughout the public participation meetings regarding the TMDL process. Resistance to the TMDL process started during TMDL development and continued through the development of the TMDL implementation plan. Resistance did not seem centered around concerns of the community rather an effort to delay or stop the implementation plan development process without even starting it. However, most members of the focus groups agreed that a cornerstone of the implementation plan is cultivating a shared sense of responsibility for reducing FC pollution and encouraging commitment and partnerships among the citizens in the watershed and government agencies. An assertion to individual responsibility provides a foundation for building partnerships among citizens, businesses, interest groups, and government agencies. It can also cultivate voluntary implementation and long-term support for reducing FC levels and restoring water quality in the North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River.



Throughout the public participation process, major emphasis was placed on discussing best management practices (BMPs) specifications, location of control measures, education, technical assistance, and funding. A BMP Advisory Committee was formed by VADCR to address potential variances to the Virginia Agricultural Best Management Practices Cost-Share Program suggested by the Agricultural and Governmental Focus Groups. It was agreed by the Agricultural and Governmental Focus Groups and the BMP Advisory Committee that appending BMP component specifications required in different programs should not be pursued. However, concern was expressed that there needed to be more flexibility in the minimum buffer distance for streamside fencing.

The Agricultural and Governmental Focus Groups agreed that potential control measures identified through the implementation plan process would be practical, cost-effective, equitable, and based on the best science and research available. Implementation of the identified control measures should be administered in a timely manner to efficiently and economically target problem areas through stages. It was determined through Steering Committee input that stream-walks must be performed during implementation to accurately identify straight pipes. The group also decided that notification would be sent to all homeowners identifying the period that individuals would be walking streams and how it is associated with the TMDL. In addition, a pump-out and inspect program will aid in identifying failed septic systems and straight pipes. Currently, the Indoor Plumbing Rehabilitation and Septic Pump-out Programs are ongoing in Franklin County and are available for citizens in the impaired watersheds.

All Focus Group and Steering Committee members agreed that education is key to getting people involved in implementation. There must be a proactive approach by agencies to contact farmers and residents to articulate exactly what the TMDL means to them and what will most practically get the job done. Several education/outreach techniques will be utilized during implementation. Articles describing the TMDL process, the reasons why high levels of fecal coliform are a problem, the methods through which the problem can be corrected, the assistance that is currently available for landowners to deal with the problem, and the potential ramifications of not dealing with the problem should be made available to the public through as many channels as possible (e.g. Farm Bureau newsletters, FSA newsletters, flyers included with water bills, and targeted mailings). Workshops and demonstrations should be organized to show landowners the extent of the problem, the effectiveness of control measures, and the process involved in obtaining technical and financial assistance. For the agricultural community, field days, pasture walks, and presentations offered through local farm groups were recommended. The emphasis was on having local farmers discuss their experiences with the cost-share programs, demonstrating the advantages of a clean water source and pasture management, and presenting monitoring results to demonstrate the problem. It is generally accepted that farmers will be more persuaded by discussion with local technical personnel or fellow farmers who have implemented the suggested control measures than through presentations made by state-agency representatives. For residential issues, small community meetings similar to small workshops proposed for the agricultural community were recommended for educating homeowners about septic system maintenance. It was generally recognized that homeowners are unaware of the need for regular septic system maintenance. A technician dealing with residential issues will contact homeowners after identification of straight pipes or failing septic systems and explain options available for correcting the problems and for funding sources. Notices using all media outlets will be posted regarding septic systems (e.g. a reminder to pump-out septic tank every 3-5 years). An educational packet will be included about septic system issues for new homeowners. Additionally, educational tools, such as a model septic system that could be used to demonstrate functioning and failing septic systems, and video of septic maintenance and repair, would be useful in communicating the problem and needs to the public.

Traditionally, funding for residential issues have fallen on the landowner and funding for agricultural practices has been both voluntary and through the state's cost-share program. In addition to traditional sources of funding, approximately $1.6 million in 319 funding will be available this year for implementation in areas that have a state-approved implementation plan. In addition to the anticipated 319 funds, funding grants will be written during implementation. Suggestions to stimulate implementation included:

1.) 25% tax credit pursued statewide for the maintenance of stream exclusion fencing and associated watering systems;
2.) Tax credit equal to cost-share percentage (e.g. up to 75%);
3.) Increase in the cost-share percentage to encourage participation in the cost-share program;
4.) Additional 15% incentive payment applied to estimated or actual cost (whichever is less) in TMDL areas for full livestock exclusion systems;
5.) Allow residents of Blackwater River Watershed to be eligible for CREP.

Assessment of Needs

The quantity of control measures required during implementation was determined through spatial analyses of land use, stream-network, elevation, building-footprint, and soils maps along with regionally appropriate data archived in the DCR Agricultural BMP Database and TMDL Development documents. The map layers and archived data were combined to establish high and low estimates of control measures required overall, in each watershed, and in each subwatershed. Additionally, input from local agency representatives and contractors were used to verify the analyses. Estimates of control practices needed for full implementation in the four watersheds are listed in Table 2.

There is approximately 275 miles of stream in the four watersheds. The total length of pasture and cropland fencing required for the four watersheds is expected to be 70 and 22 miles, respectively. Associated with the streamside fencing through pasture are 238 full livestock exclusion systems consisting of streamside fencing, cross fencing and watering source. Streamside fencing of cropland will not require a full livestock exclusion system; instead, it is assumed that temporary poly-wire will be used to restrict livestock from entering stream.

Table 2 Estimation of average control measures with unit cost needed during implementation for agricultural and residential programs in North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River Watersheds.

Control Measure	Unit	Estimated Units Needed	Average Cost / Unit ($)
Agricultural Program:			
Full Exclusion System	system	238	14,128
Cropland Fencing	feet	119,000	1.10
Hardened Crossing	system	117	2,000
Technical Assistance	man-year	15	50,000
Administrative Assistance	man-year	7.5	35,000
Residential Program:			
Septic System	system	7	2,500
Alternative Waste Treatment System	system	8	7,500
Technical Assistance	man-year	1	50,000
Administrative Assistance	man-year	0.5	35,000

The number and location of straight pipes were based on numbers reported in the TMDL. In North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River, three, two, two, and eight straight pipes, respectively, were distributed between subwatersheds. The 15 straight pipes must be identified and replaced during implementation since a 100% load reduction from straight pipes was deemed necessary to meet the TMDL goal.

To determine the number of man-years necessary for agricultural technical assistance during implementation, the total practices needed to be installed per year during implementation was divided by the number of BMPs that a technician from BRSWCD has historically processed in a year. As a result, 15 technical man-years and 7.5 administrative man-years are needed to provide agricultural technical assistance through five years of implementation. Members of the Steering Committee estimated that one technical man-year and a half administrative man-year would be required to provide residential technical assistance and educational outreach tasks identified during plan development. The number of man-years needed to provide technical assistance during implementation in the four watersheds is listed in Table 2.

Cost / Benefit Analysis

Associated cost estimations of systems needed for full livestock exclusion reductions were calculated by multiplying the unit cost per the number of units in each subwatershed (Table 2). As depicted in Table 3, the total average cost to install control measures that will ensure full livestock exclusion from streams in the four watersheds is $3.75 million excluding technical assistance.

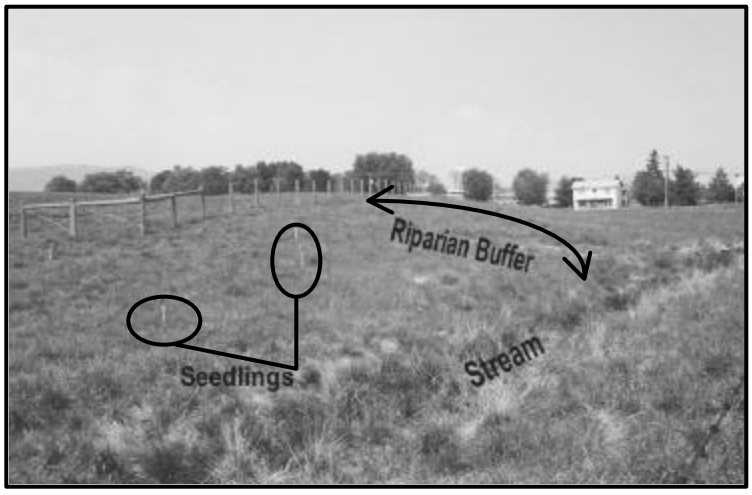
Cost estimations to replace identified straight pipes were based on the combination of new septic systems or alternative waste treatment system. Without site surveys at each location where system replacement/installation is required, it is difficult to determine the proportion of sites needing alternative systems. In this light, it was assumed that sites were evenly split between needing standard systems (i.e. septic systems) and alternative systems (e.g. peat moss filter systems). The total cost estimated for replacement/installation of private sewage systems was $80,000.

It was determined by the BRSWCD, DCR, VDH, and Steering Committee members that it would require $50,000 and $35,000 to support the salary, benefits, travel, and training

of one technical man-year and administrative man-year, respectively. With quantification analysis yielding a need for 15 technical man-year and 7.5 administrative man-year, the total cost to provide agricultural technical assistance during implementation is expected to be $1.01 million (Table 3). For residential technical assistance, approximately $70,000 is needed to support one technical man-year and half an administrative man-year (Table 3).

Table 3 Estimated total implementation cost for agricultural BMPs, residential BMPs, and technical assistance in North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River Watersheds.

Implementation Needs	Average Total Cost (in million $)
Livestock Exclusion BMPs	3.75
Residential BMPs	0.08
Technical Assistance	
Agricultural Programs	1.01
Residential Programs	0.07
Total	4.91

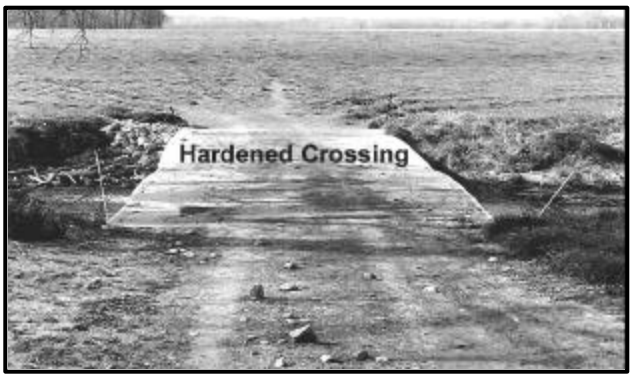


The primary benefit of implementation is cleaner waters in Virginia. Specifically, fecal contamination in North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River will be reduced to meet water quality standards. It is hard to gage the impact that reducing fecal contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, because of the reductions required, the incidence of infection from fecal sources, through contact with surface waters, should be reduced considerably. Additionally, because of stream-bank protection that will be provided through exclusion of livestock from streams, and restoration of the riparian area through anticipated implementation of the Conservation Reserve Enhancement Program (CREP) in some areas, the aquatic habitat will be improved and progress will be made toward reaching future TMDLs (e.g. General Quality standard (Benthic)) in these waters. The vegetated buffers that are established will also serve to reduce sediment and nutrient transport to the stream from upslope locations. In areas where pasture management is improved through implementation of grazing-land-protection BMPs, soil and nutrient losses should be

reduced, and infiltration of precipitation should be increased, decreasing peak flows downstream.

An important objective of the implementation plan is to foster continued economic vitality and strength. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities. The agricultural and residential practices recommended in this document will provide economic benefits to the landowner, as well as, the expected environmental benefits. Specifically, alternative (clean) water sources, exclusion of cattle from streams, intensive pasture management, and private sewage system maintenance will each provide economic benefits.

A clean water source has been shown to improve weight gain and milk production in cattle. Fresh clean water is the primary nutrient for livestock with healthy cattle consuming, on a daily basis, close to 10% of their body weight during winter and 15% of their body weight in summer. Many livestock illnesses can be spread through contaminated water supplies. For instance, coccidia can be delivered through feed, water and haircoat contamination with manure (VCES, 2000). In addition, horses drinking from marshy areas or areas where wildlife or cattle carrying Leptospirosis have access tend to have an increased incidence of moonblindness associated with Leptospirosis infections (VCES, 1998b). A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills. In addition to reducing the likelihood of animals contracting waterborne illnesses by providing a clean water supply, streamside fencing excludes livestock from wet, swampy environments as are often found next to streams where cattle have regular access. Keeping cattle in clean dry areas has been shown to reduce the occurrence of mastitis and foot rot. The Virginia Cooperative Extension Service (1998a) reports that mastitis currently costs producers $100 per cow in reduced quantity and quality of milk produced. On a larger scale, mastitis costs the U.S. dairy industry about $1.7-2 billion annually or 11% of total U.S. milk production. While the spread of mastitis through a dairy heard can be reduced through proper sanitation of milking equipment, mastitis-causing bacteria can be harbored and spread in the environment where cattle have access to wet and dirty areas. Implementation of streamside fencing and well managed loafing areas will reduce the amount of time that cattle have access to these areas.



Taking the opportunity to instigate an improved pasture management system in conjunction with installing clean water supplies will also provide economic benefits for the producer. Improved pasture management can allow a producer to feed less hay in winter months, increase stocking rates by 30 - 40%, and consequently, improve the profitability of the operation. With feed costs typically responsible for 70-80 percent of the cost of growing or maintaining an animal, and pastures providing feed at a cost of .01-.02 cents/lb of total digestible nutrients (TDN) compared to .04-.06 cents/lb TDN for hay, increasing the amount of time that cattle are fed on pasture is clearly a financial benefit to producers (VCES, 1996). Standing forage utilized directly by the grazing animal is always less costly and of higher quality than the same forage harvested with equipment and fed to the animal. In addition to reducing costs to producers, intensive pasture management can boost profits, by allowing higher stocking rates and increasing the amount of gain per acre. A side benefit is that cattle are more closely confined allowing for quicker checking and handling. In general, many of the agricultural BMPs being recommended will provide both environmental benefits and economic benefits to the farmer.

The residential programs will play an important role in improving water quality, since human waste can carry with it human viruses in addition to the bacterial and protozoan pathogens that all fecal matter can potentially carry with it. In terms of economic benefits to homeowners, an improved understanding of private sewage systems, including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. The average septic system will last 20-25 years if properly maintained. Proper maintenance includes; knowing the location of the system components and protecting them by not driving or parking on top of them, and not planting trees where roots could damage the system, keeping hazardous chemicals out of the system, and pumping out the septic tank every 3 to 5 years. The cost of proper maintenance, as outlined here, is relatively inexpensive in comparison to repairing or replacing an entire system. Additionally, the repair/replacement and pump-out programs will benefit owners of private sewage (e.g. septic) systems, particularly low-income homeowners, by sharing the cost of required maintenance.

Implementation

Potential funding sources available during implementation were identified during plan development. Detailed description of each source can be obtained from the BRSWCD, VADCR, NRCS, VCES, and VADEQ. Sources include:

- Federal Clean Water Section 319 Incremental Funds
- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program

- Virginia Agricultural Best Management Practices Loan Program
- Virginia Small Business Loan Program
- USDA Conservation Reserve Program (CRP)
- USDA Conservation Reserve Enhancement Program (CREP)
- USDA Environmental Quality Incentives Program (EQIP)
- USDA Wildlife Habitat Incentive Program (WHIP)
- USDA Wetland Reserve Program (WRP)
- Southeast Rural Community Assistance Project (SE/R-CAP)

One possible scenario for funding in the first year is presented in Table 4. This scenario represents 25% installation of needed agricultural systems addressing livestock exclusion (i.e. full livestock exclusion system, cropland fencing, and hardened crossings), 50% of straight pipes replaced (i.e. 50% with septic system and 50% with alternative system), two agricultural technical man-years, 0.5 agricultural administrative man-years, 0.5 residential technical man-years, and 0.25 residential administrative man-years. The scenario also takes into account 1.5 agricultural technical and one administrative man-year, respectively, currently funded with anticipation of same level of funding to continue.

Table 4 One possible scenario for funding in the first year.

Funding Source	Agricultural ($)	Residential ($)	Total ($)
Landowner	362,000	28,000	390,000
Tax Credits	60,000	0	60,000
PL566	147,000	0	147,000
319 Incremental Funds			
Practices	367,000	6,000	373,000
Technical Assistance	93,000	34,000	127,000
EQIP	0	0	0
CREP	0	0	0
Southeast R-CAP	0	3,000	3,000
Current Funded Technical	110,000	0	110,000
Total:	*1,139,000*	*71,000*	*1,210,000*

Progress toward end goals will be assessed during implementation through tracking of control measure installations and continued water quality monitoring. It is recommended that continued water quality monitoring be conducted based on the existing monitoring network and spatial distribution of the staged implementation plan. Water quality analysis should include fecal coliform enumerations and BST analysis. BST will provide an indication of the effectiveness of specific groups of control measures, particularly agricultural and urban.

Implementation is scheduled to begin in July 2001 after which three milestones need to be met within the next ten years (Figure 3). The first milestone will be two years after implementation begins, whereby 50% of the livestock exclusion systems and 100% of the

residential control measures will be installed with a 1% to 26% expected reduction in exceedances of geometric mean water quality standard (Table 5). After five years from the start of implementation, 100% of the livestock exclusion systems will be installed resulting in a 94% to 100% anticipated reduction in exceedances. The final milestone will be delisting of the impaired segments from the Commonwealth of Virginia's 303(d) List of Impaired Waters, which is anticipated to occur by 2011. Based on meeting the above milestones, a five-year implementation plan outline was formulated as depicted in Tables 6 and 7.

Table 5 Estimation of fecal coliform geometric mean water quality standard violations at each milestone in North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River Watersheds.

Milestone	**GM Exceedances at Outlet of:**			
	***North Fork Blackwater River* (%)**	***South Fork Blackwater River* (%)**	***Upper Blackwater River* (%)**	***Middle Blackwater River* (%)**
Existing	83	98	100	82
1	74	79	99	61
2	0	3	6	2
3	0	0	0	0

Implicit in the process of a staged implementation is targeting of control measures. Targeting ensures optimum utilization of resources. Targeting of critical areas for BMP installation was accomplished through analysis of land use, farm boundaries, stream network GIS layers, and monitoring results. Monitored data collected during the development process was used together with spatial analysis results to identify subwatersheds where initial implementation resources would result in the greatest return in water quality improvement. If feasible, effort should be made to concentrate resources first in the following subwatersheds: NFB-3, NFB-4, SFB-2, SFB-3, UPB-1, UPB-2, MIB-1, MIB-2, and MIB-6. Spatial analysis was performed to identify residents within 300 feet of a stream. Using the results, efforts can be made to contact identified residents first during implementation to address straight pipes.

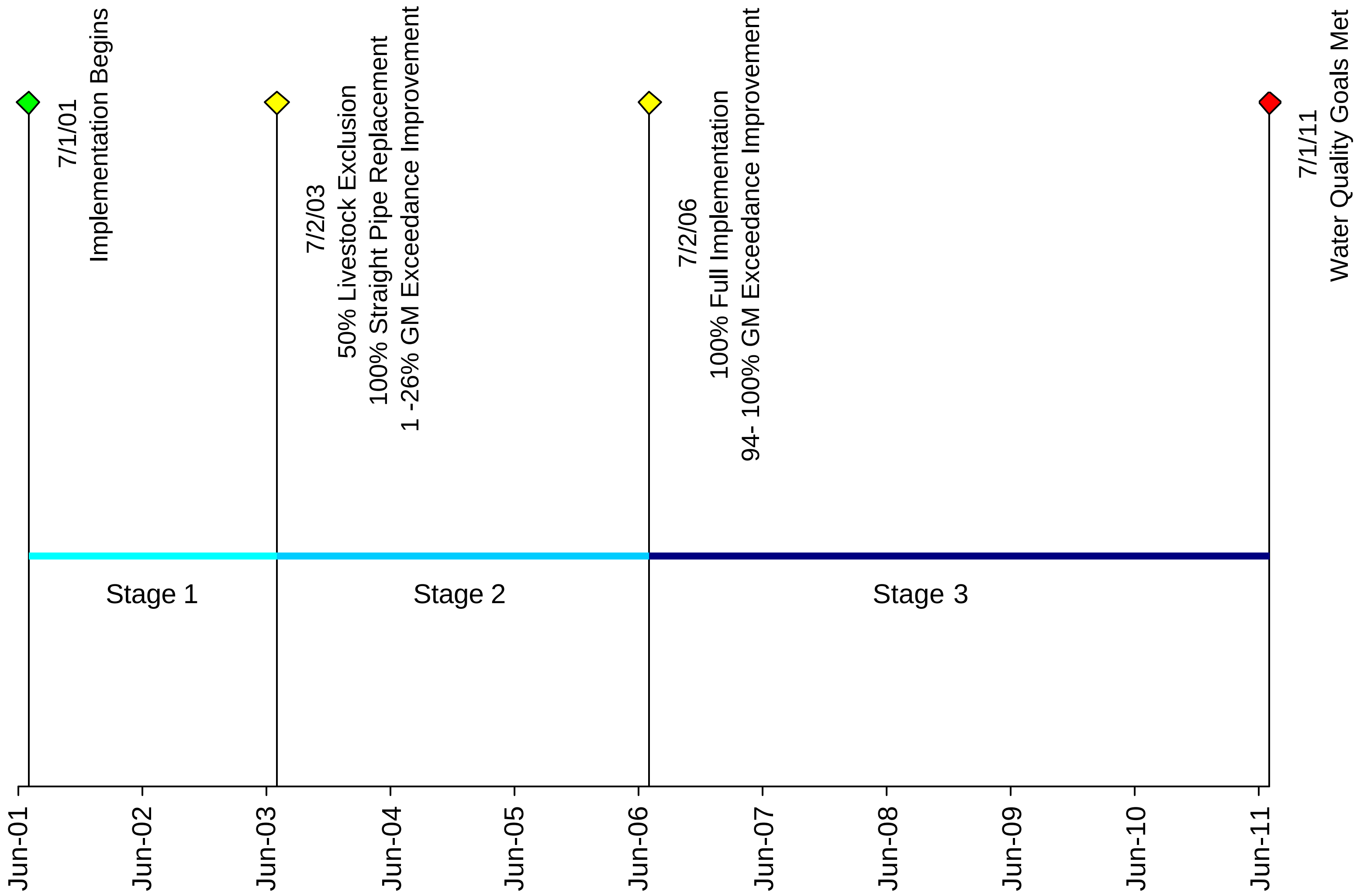


Figure 3 **Implementation milestones for North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River Watersheds.**

Table 6 **Percentage of practices to be installed addressing livestock exclusion and straight pipes with amount of technical assistance needed in North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River Watersheds.**

Date	Livestock Exclusion	Straight Pipes	Agricultural Technical Assistance		Residential Technical Assistance	
			Technical	*Administrative*	*Technical*	*Administrative*
(year)	(%)	(%)	(man-year)	(man-year)	(man-year)	(man-year)
1	25	50	3	1.5	0.5	0.25
2	25	50	3	1.5	0.5	0.25
3	17	0	3	1.5	0	0
4	17	0	3	1.5	0	0
5	16	0	3	1.5	0	0
Total	*100*	*100*	*15*	*7.5*	*1*	*0.5*

Table 7 **Cost associated with percentage of practices installed addressing livestock exclusion and straight pipes with technical assistance needed in North Fork Blackwater River, South Fork Blackwater River, Upper Blackwater River, and Middle Blackwater River Watersheds.**

Date	Livestock Exclusion	Straight Pipes	Agricultural Technical Assistance		Residential Technical Assistance		Total Cost Per Year
			Technical	*Administrative*	*Technical*	*Administrative*	
(year)	($)	($)	($)	($)	($)	($)	($)
1	938,000	40,000	150,000	53,000	25,000	9,000	1,215,000
2	938,000	40,000	150,000	53,000	25,000	9,000	1,215,000
3	638,000	0	150,000	53,000	0	0	841,000
4	638,000	0	150,000	53,000	0	0	841,000
5	600,000	0	150,000	53,000	0	0	803,000
Total	*3,752,000*	*80,000*	*750,000*	*265,000*	*50,000*	*18,000*	*4,915,000*

Stakeholder's Roles and Responsibilities

Achieving the goals of this effort (i.e. improving water quality and removing these waters from the impaired waters list) is without a doubt dependent on stakeholder participation. Not only the local stakeholders charged with implementation of control measures, but also the stakeholders charged with overseeing our nation's human health and environmental programs must first acknowledge there is a water quality problem and then make changes in our operations, programs, and legislation to address these pollutants.

The United States Environmental Protection Agency (USEPA) has the responsibility of overseeing the various programs necessary for the success of the Clean Water Act (CWA). However, administration and enforcement of such programs falls largely to the states. In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. Currently, there are four state agencies responsible for regulating activities that impact water quality in Virginia. These agencies include: Virginia Department of Environmental Quality (VADEQ), Virginia Department of Conservation and Recreation (VADCR), Virginia Department of Agriculture and Consumer Services (VDACS), and Virginia Department of Health (VDH).

VADEQ has responsibility for monitoring the waters to determine compliance with state standards, and for requiring permitted, point dischargers to maintain loads within permit limits. They have the regulatory authority to levy fines and take legal action against those in violation of permits. Beginning in 1994, animal waste from confined animal facilities in excess of 300 animal units (cattle and hogs) has been managed through a Virginia general pollution abatement permit. These operations are required to implement a number of practices to prevent groundwater contamination. In response to increasing demand from the public to develop new regulations dealing with animal waste, in 1999, the Virginia General Assembly passed legislation requiring VADEQ to develop regulations for the management of poultry waste in operations having more than 200 animal units of poultry (about 20,000 chickens), (ELI, 1999).

VADCR holds the responsibility for addressing nonpoint sources (NPS) of pollution. One such program is Virginia's Erosion and Sediment Control Law. Under this provision, a person must have an approved erosion and sediment control plan and a certification that the plan will be implemented before they can obtain a building permit. However, most VADCR programs dealing with agricultural NPS pollution historically have been through education and voluntary incentive programs. These cost-share programs were originally developed to meet the needs of voluntary partial participation and not the TMDL-required 100% participation of stakeholders. To meet the needs of the TMDL program and achieve the goals set forth in the CWA, the incentive programs must be reevaluated to account for 100% participation. It should be noted that VADCR does not have regulatory authority over the majority of issues addressed here except for the Erosion and Sediment Control program.

Through Virginia's Agricultural Stewardship Act, VDACS Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water

quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken which can include a civil penalty up to $5,000 per day. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, etc. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures. The Agricultural Stewardship Act is entirely complaint driven. As of May of this year, 152 complaints, of which 38% were founded, had been received statewide since the initiation of the legislation. No fines have resulted from these complaints.

VDH is responsible for maintaining safe drinking water measured by standards set by the USEPA. Their duties also include septic system regulation and regulation of biosolids land application. Like VDACS, VDH is complaint driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. In the scheme of these TMDLs, VDH has the responsibility of enforcing actions to correct or eliminate failed septic systems and straight pipes, respectively.

State government has the authority to establish state laws that control delivery of pollutants to local waters. Local governments in conjunction with the state can develop ordinances involving pollution prevention measures. In addition, citizens have the right to bring litigation against persons or groups of people who can be shown to be causing some harm to the claimant. Through hearing the claims of citizens in civil court, and the claims of government representatives in criminal court, the judicial branch of government also plays a significant role in the regulation of activities that impact water quality.

The Clean Water Act Section 303(d) calls for the identification of impaired waters. It also requires that the streams be ranked by the severity of the impairment and a Total Maximum Daily Load be calculated for that stream that would bring its water back into compliance with the set water quality standard. Currently, TMDL implementation plans are not required in the Federal Code (pending administrative proceedings) however; Virginia State Code does incorporate the development of implementation plans for impaired streams. The nonpoint source part of the Clean Water Act was largely ignored by EPA until citizens began to realize that regulating only point sources was no longer maintaining water quality standards. Beyond the initiation of the CWA, the entire TMDL program has been complaint driven. Lawsuits from citizens and environmental groups citing USEPA was not carrying out the statutes of the CWA began as far back as the 1970's and have continued until the present. In the state of Virginia in 1998, the American Canoe Association and the American Littoral Society filed a complaint against EPA for failure to comply with provisions of §303d. The suit was settled by Consent Decree, which contained a TMDL development schedule through 2010. It is becoming more common for concerned citizens and environmental groups to turn to the courts for the enforcement of water quality issues.

In 1989, concerned residents of Castile, Wyoming County New York filed suit against Southview Farm. Southview had around 1,400 head of milking cows and 2,000 total head of cattle. Tests on citizen's wells found them contaminated with nitrates traced to irresponsible handling of animal wastes by Southview. In 1990, Southview was given a notice of violation under the Clean Water Act. Rather than change their farming practices or address the contaminated wells they ignored the warning. In 1995, after court hearings and an appeal, the case was finally settled. Southview had to donate $15,000 to the Dairy Farms Sustainability Project at Cornell University, pay $210,000 in attorney fees for the plaintiff, and employ best management practices (Knauf, 2001). Closer to home, on the Eastern Shore of Virginia, an aquaculture operation, raising clams and oysters, sued his neighbor, a tomato grower. The aquaculture operation owner claimed the agricultural runoff created from the plasticulture operation was carrying pollutants that were destroying his shellfish beds. The suit was settled out of court in favor of the aquaculture operation owner for an undisclosed amount.

Successful implementation depends on stakeholders taking responsibility for their role in the process. The primary role, of course, falls on the landowner. However, local, state and federal agencies also have a stake in seeing that Virginia's waters are clean and provide a healthy environment for its citizens. An important first step in correcting the existing water quality problem is recognizing that there is a problem and that the health of citizens, particularly those who are least able to protect themselves (i.e. children), is at stake. While it is unreasonable to expect that the natural environment (e.g. streams and rivers) can be made 100% free of risk to human health, it is possible and desirable to minimize manmade problems. Virginia's approach to correcting NPS pollution problems has been and continues to be encouragement of participation through education and financial incentives. However, if voluntary approaches prove to be ineffective and the public "will" is to force compliance with existing laws through court actions, then landowners may be required to implement corrective actions without economic assistance from the state and may face punitive fines for non-compliance.

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